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Research Article

Enhancement of Seed Germination and Seedling Growth of Korarima (*Aframomum corrorima*) at Humid Tropical Climatic Conditions

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Abstract

Korarima (Aframomum corrorim) (is an indigenous spice and cash crop in Ethiopia. Korarima seed has less peppery pungent taste, and milder, sweeter flavor. Potentially it grows under the natural forests in the south and southwestern parts of the country where coffee potentially grow. But the crop shows delayed seed germination and poor field emergency at growing area. So obtaining fast seed germination and intact seedling is the main concern for farmers. The objective of this trial was to assess the potential of seed treatment chemicals on seed germination and seedling development of korarima. The trial was organized in completely randomized design with three replications. Analysis of Variance was done using statistical analysis software. Treatment means were separated using LSD at 0.05 probability level of significance. The results of the trial was designated that korarima seed germination and seedling development were significantly ($P \leq 0.05$) enhanced by pre sowing seed treatment. The supreme seed germination value (83.25%) was shown by korarima seeds soaked with 80% alcohol for 30 min, whereas the lowest seed germination (47.53%) was seen from seeds soaked with 10% H_2SO_4 for 5 min. Based on these result, it can conclude pre-sowing seed treatment of Korarima enhanced seed germination and intact seedling development of korarima.

Keywords

Korarima, *Aframomum corrorima*, Seed Germination, Seed Treatment, Dormancy

1. Introduction

Korarima (*Aframomum corrorim)* (is an indigenous spice and cash crop in Ethiopia. Korarima seed has a less peppery pungent taste, and milder, sweeter flavor. Potentially it grows under the natural forests in the south and southwestern parts of the country where coffee grows. Korarima spice has been part of each and daily Ethiopian dish in preparation of curry powder for culinary purpose [1]. Korarima seeds are used to flavor all kinds of "Wet", for which they are ground and usually mixed with other spices, to flavor coffee; sometimes tea and bread compared with other species. The capsule had been used as money for barter on olden times. Korarima had been one of the neglected (little attention) spices. Recently

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this spice has been given a due attention and collection of a number of korarima accessions was achieved and varieties were released [2].

But delayed seed germination and poor field emergency of seed were the main concerns of korarima growers. Poor stored food reserve in the endosperm might be a reason for the very slow growth of korarima seed. So, pre sowing seed enhancement required in korarima production and breeding program for testing and using available genotypes. The application of some seed enhancement to make the hard seed coat of korarima permeable to water and gases [3, 14, 15]. Therefore, the objective of this study was to evaluate the effects of different seed treatment on seed germination and seedling development of korarima.

2. Materials and Method

2.1. Description of the Study Area

The experiment was conducted in Tepi Agricultural Research Center during 2020 to 2022. Tepi is located in South Nation Nationality Regional State, E, with an elevation of 1200 m. a. s. l, at Latitude of 7^0 10' 54.5'' N and with a Longitude of 35^0 25' 04.3-28.2'' E of Ethiopia. The research station receives an average annual rainfall of 1559 mm annually with maximum and minimum temperatures of 30.23°C and 16.09°C,, respectively.

2.2. Experimental Design and Treatment Setup

Matured fruits of korarima were collected from Tepi Agricultural Research Center. The collected fruits were carefully pulped, washed and dried under shade. Target cleaned seed were taken and divided into nine groups and subjected to different seed treatments based on each treatment setup. Each group of treated seeds were divided into three (100 seeds each) and were sown in plastic pots containing forest soil, clay loam and sand (3: 1: 1) mixture at nursery. The experiment was arranged in CRD with three replications. Seedling growing pots watered once a day.

2.2.1. Treatments Were

1. Tap water
2. Sulfuric acid (H_2SO_4)
3. HNO_3
4. Acetic acid (CH_3COOH)
5. Alcohol 80% (C_2H_6O)

2.2.2. Preparation of Treatments

1. No treatment
2. Soaked seeds in tap water for 12 hrs
3. Soaked seeds in tap water for 24 hrs
4. Soaked seeds in 5% sulfuric acid (H_2SO_4) for 10 min
5. Soaked seeds in 5% sulfuric acid (H_2SO_4) for 5 min
6. Soaked seeds in 25% HNO_3 for 10 min
7. Soaked seeds in 25% HNO_3 for 5 min
8. Soaked seeds in 25 per cent Acetic acid for 10 min
9. Soaked seeds in 80% alcohol for 30 minutes

2.3. Data Collection

Germination percentage (%): number of seeds germinated out of 100 seeds of each replication starting from the first day of germination to the end of the germination period; days of 50% germination achieved, Percentage of intact seedlings, seedling height (cm), number of roots and root length (cm) were recorded.

2.4. Data Analysis

Data collected were tested for fitting the normality assumptions of the ANOVA. Then, all data were subjected to analysis of variance using SAS statistical software version 9.2 (SAS Institute Inc., 2008) as per standard procedures. To compare the means of the treatments, the least significant difference (LSD) test was applied at a 5% significance level, following the method sketched by Gomez and Gomez (1984).

3. Results and Discussion

Bartlett's test of homogeneity of variances of the two year data showed homogenous at (p 5%), hence analysis of variance was carried out by combining the two year data.

Standard germination was significantly ($P \leq 0.05$) enriched by pre sowing seed treatment (Table 1). Korarima seeds start sprout at three weeks after planting and the uppermost number of seedling (10.12 %) were germinated for seed soaked in tap water for 24 hrs. but the lowermost mean value of germinated seeds (5.15%) were registered for seed soaked at 25% HNO_3 for 10 min. The highest number of days (57) was recorded to achieve 50% of korarima seed germination by seed soaked with 10% H_2SO_4 for 5 min.) but comparatively the least number of days was recorded (35) for 50% seed germination achieved by seeds soaked with 80% alcohol for 30 min. The maximum seed germination value (83.25%) was obtained by seeds soaked with 80% alcohol for 30 min, while the lowermost seed germination (47.53%) was recorded by seeds soaked with 10% H_2SO_4 for 5 min. at six week after sowing. Seed germination was not observed in all treatments after six weeks (Table 1).

Table 1. Potential of seed treatment on seed germination and seedling development of korarima.

Treatments	Days to 50% germination	Germination % in weeks interval from sowing			
		three	four	five	six
T1 No treatment	44.45cd	5.40bc	19.6bc	61.45e	61.45e
T2 (H20 for 12 hrs.)	46.10cd	7.54ab	24.56ab	69.45c	69.45c
T3 (H20 for 24 hours.)	51.16bc	10.12a	28.00a	59.61f	59.61f
T4 (5% H2SO4 5 min)	48.44bc	8.24ab	22.12bc	67.38d	67.38d
T5 (5% H2SO4 for 10 min)	57.00a	9.21ab	17.11bc	47.53i	47.53i
T6 (25% HNO3 for 5 min)	52.0bc	6.88bc	22.7ab	58.40g	58.40g
T7 (25% HNO3 for 10 min)	55.66ab	5.15e	18.23bc	51.55h	51.55h
T8 (25% Acetic Acid for 10 min)	42.00de	6.43bc	16.85c	70.56b	70.56b
T9 (80% alcohol for 30 min)	35.66e	10.10ab	27.66ab	83.25a	83.25a
LSD (0.05)	4.95	2.89	5.52	0.28	0.29
CV (%)	5.22	5.00	5.72	6.88	6.89

LSD = least significant difference, CV (%) = coefficient of variation

The highest seedling and root length value (2.78 cm, 2.89 cm) were recorded for seed soaked with 80% alcohol for 30 min whereas the lowest seedling and root length value were recorded seed soaked with 5% H_2SO_4 for 10 min. 1.28cm. In general uppermost mean value of number of roots were observed for seeds soaked with 80% alcohol for 30 min. but the lowermost mean value of root number were observed for un treated seed. Maximum number of normal seedling (83%) was recorded for seed soaked with 80% alcohol for 30 min. but the lowest mean value of normal seedling (49) was recorded for 5% H_2SO_4 for 10 min). Generally, seed soaked with 80% alcohol for 30 min were significantly enhanced korarima seed germination, seedling length, roots number and root length, (Table 2).

The results of the present study indicated that seed treatment had significant and positive effect on different aspects of seed quality indices improvements, such as seed germination, growth and biochemical parameters.

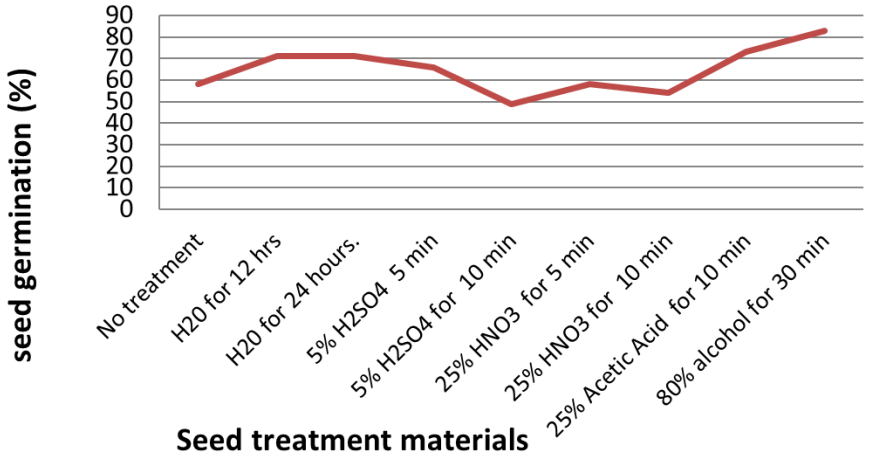

Figure 1. Potential of seed treatment on seed germination performance of korarima.

The response of crop for different seed treatments were interpreted in terms of germination percentage, speed of germination, seedling vigor, seedling length, root length, shoot length test. Korarima seeds display dormancy that can be released by seed pre-treatment for a certain period. Korarima seed treated with 80% alcohol for 30 min. was the most effi-

cient in breaking dormancy and stimulating germination. El-Dengawy, E. F. A. 2015 found that GA3, alcohol and sulfuric acid treated loquat seeds gave significantly higher germination percentage than the control when recorded after eight weeks of sowing [4]. The superiority of the sulfuric acid treated seeds compared with the other tested treatments on germination percentage was reported from tamarind seeds by [5]. The effect of seed treatment on promotion of seed germination might be due to the highly desiccant effect of the alcohol and other treating chemicals on the seed coat there by allowing easier water uptake and oxygen diffusion [8], and [9]. The inhibitory effects on germination and growth of seedling due to high constituents of hydrocarbon monoterpenes were investigated in different plants [6, 7, 13] reported the higher contents of monoterpene from korarima seed. Seed germination and subsequent seedling growth of horticultural and other crop seeds can be enhanced through pre sowing chemical treatments practices, [10-12]. This might be another reason for poor germination and seedling growth in korarima. From the present results it can be concluded that soaking of korarima seeds with T9 (80% alcohol for 30 min.) may be recommended to promote germination process and enhance growth characteristics of the seedlings of korarima.

Table 2. *Effects of seed treatment on seed germination and seedling growth of korarima.*

Treatments	Seedling Height (cm)	Number of root	Root length (cm)	Percentage of normal seedling
T1 No treatment	2.46d	3.00c	2.05bc	58cd
T2 (H_20 for 12 hrs.)	2.48cd	4.91ab	1.95bc	71bc
T3 (H_20 for 24 hours.)	2.40de	4.95ab	2.45a-c	71bc
T4 (5% H_2SO_4 5min)	2.53b-d	3.74c	2.37a-c	66bc
T5 (5% H_2SO_4 for 10 min)	2.18e	4.40b	1.28d	49f
T6 (25% HNO_3 for 5 min)	2.66.5a	4.61ab	1.96bc	58cd
T7 (25% HNO_3 for 10 min)	2.63ab	3.33c	2.36a-c	54cd
T8 (25% Acetic Acid for 10 min)	2.67a	4.95a	2.03bc	73ab
T9 (80% alcohol for 30 min)	2.78a	5.11a	2.89a	83a
LSD (0.05)	0.23	0.64	0.77	12
CV (%)	6.2	7.20	7.35	7.26

LSD = least significant difference, CV (%) = coefficient of variation

4. Conclusion

The present study revealed that, korarima (*Aframomum corrorima)* seeds soaked with 80% alcohol for 30 minutes was potentially enhanced seed germination and seedling development. Hence, seed treated with 80% alcohol for 30 minutes be suggested to stimulate the korarima seed propagation potential and seedling development.

Abbreviations

LSD	Least Significant Difference
CV (%)	Coefficient of Variation
CRD	Completely Randomized Design
SAS	Statistical Analysis Software
ANOVA	Analysis of Variance

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Author Contributions

Hassen Seid Awoke designed, conducted the experiment, data analysis and manuscript writing, Karta Kaske Kalsa contributed to guiding during the article preparation and editing, Tsegaye mulualem and Getachew Shiferaw participated on data collection.

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Data Availability Statement

Data can access through the permission of the funding organization.

Conflicts of Interest

The authors declare no conflicts of interest.

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